

New Jersey coast, from 6,000 to 7,900 miles; Key West, 6,956 miles; Wilmington, 6,786 miles, and Escanaba 6,690 miles. The smallest movements have occurred at Lynchburg, 2,037 miles; Nashville, 2,561 miles; Wytheville, 2,847 miles; Louisville, 2,859 miles; Indianapolis, 2,901 miles.

VERIFICATION OF "PROBABILITIES" AND CAUTIONARY SIGNALS.

The usual critical comparison of the published "Probabilities" with the weather-conditions actually following their publication shows that, on the average, for all the districts in the United States for which predictions were made, 91.94 per cent. have been verified. The per centage of omissions to predict is, for the whole country, 0.16.

During the month, the total number of Cautionary Signals ordered to be displayed at the forty-three Signal Stations on the Lakes and Atlantic coast, has been two. This is a small number, compared with that of previous months. Of the two signals displayed, one was justified by the fact of succeeding high winds. One was not justified.

NAVIGATION.

On Chart No. III., is given the usual table, showing the highest and lowest water-marks of the month. The Red river, at Shreveport, fell steadily during the month. Up to the middle of the month, the upper Mississippi was at its highest, but then fell and was very low north of Keokuk when the month closed, being six inches below bench-mark on the 31st at La Crosse, Wis. The Cumberland, at Nashville, reached its maximum height on the 19th. The lower Missouri fell towards the close of July.

The Ohio was highest on the 30th, at Louisville, Ky., and Laconia, Ind.

The floods, which were so general in the first week of August, had not become fully enough developed in July to call for extended notice in the current Review. Their history belongs to the meteorology of August.

TEMPERATURE OF THE WATER.

This item is given in the table in the lower right-hand corner of Chart No. II. Generally, the variation in the temperature of the water has been small, not exceeding 8° in the month. The exceptions or greatest variations are at Duluth, 25°; Yankton, 15°; Pittsburgh and Milwaukee, 12°; Omaha, 11°; Leavenworth, Escanaba and Marquette, 10°. The least thermometric changes have been at Augusta, Ga., 6°; Charleston, S. C., 2°; Indianola, Texas, 2°; Memphis, 3°; Eastport, Me., 5°; Savannah, 3°, and Portland, Me., 0°.

OPTICAL PHENOMENA.

(1) *Solar halos* were observed on the 1st, in New York, Ohio and Wisconsin; 3d, Maine, New Hampshire and Vermont; 5th, Illinois; 6th, New York; 8th, New Jersey, New York and Wisconsin; 9th, New Hampshire and Ohio; 10th, Kansas; 11th, Iowa; 14th, New York and Tennessee; 15th, Dakota; 17th, Illinois and Tennessee; 18th, Tennessee; 19th and 20th, Nebraska; 21st, Canada; 22d, Maine, Massachusetts, Mississippi and New York; 23d and 25th, Ohio; 26th, Nebraska and New Hampshire; 28th, Michigan and Tennessee; 29th, Massachusetts, New Hampshire, New York and Vermont; 30th, Canada and Wisconsin; 31st, Iowa, Michigan, New York, Ohio, Pennsylvania and Wisconsin.

(2) *Lunar halos* were reported as follows: On the 7th, in Louisiana, Mississippi; 8th, Louisiana, New Jersey and Wisconsin; 9th, Illinois; 10th, Illinois and Virginia; 12th, Alabama, Florida, Iowa and Texas; 13th, Alabama, New Jersey and Wisconsin; 14th, Tennessee and Wisconsin; 15th, Iowa and Tennessee; 16th, Mississippi and Ten-

nessee; 17th, Louisiana, Ohio, Pennsylvania and Tennessee; 18th Kansas and Tennessee; 28th, Virginia; 30th, Virginia and Wisconsin; 31st, Virginia.

(3) *Lunar rainbows* noticed at Richmond, Va., on the 17th, and at Baxter Springs Kan., on the 14th.

ATMOSPHERIC ELECTRICITY.

Thunder-storms.—This feature of the July weather has been already sufficiently exhibited by the data under head of *Local Storms and Tornadoes*.

Auroras were unusually scarce. One was observed at Alpena, Mich., on the 10th. It first appeared as a faint arch of light of a pale, white color, reaching an elevation of twenty degrees, at 10:30 p. m. At 11 p. m. it was marked by a few faint streamers; also a well-defined dark segment. From 11 p. m. to 11:30, it increased in brilliancy, and at 11:40, changed into the shape of a curtain of light, about thirty-five degrees high, of a bright, emerald-green color, the fold of the curtain moving from east to west and west to east, the westerly motion being the most frequent. At 11:56 p. m. the curtain showed a nearly complete circle of bright green, yellow and crimson colors, and shortly after, broke up in streamers of a pale, green color, having an elevation of seventy degrees, and finally subsided into a pale, hazy arch of white, which remained until daylight.

At Marquette, Michigan, on the 26th, a faint auroral arch was distinguished in the northern horizon, about 9:40 p. m., and slowly disappeared at 11 p. m. The elevation of the topmost portions of the arch at no time exceeding twenty degrees.

Auroras were reported at Mount Washington, on the 3d; Standish, Me., on the 28th; St. Paul, Minn., on the 27th, and Bangor, Me., on the 30th.

MISCELLANEOUS PHENOMENA.

(1) *Natural History*.—The items of special interest under this head are—

Grasshoppers and locusts, which were reported as follows: At Burlingame, Kansas, large numbers passed north on the 15th and 16th. At Newark, N. J., they were numerous on the 18th. At Plattsmouth, Neb., grasshoppers were reported flying west on the 2d, south on the 6th, and northwest on the 7th and 8th. At Colton, Kan., they flew southwest on the 6th, west on the 7th, and northwest on the 8th. Except a few stragglers, the grasshoppers left Virginia City, M. T., on the 22d, their first appearance there having been reported on the 18th.

Colorado Beetles, destructive to potatoes, during the month at Vineland, N. J.

(2) *Polar bands* at Wytheville on 1st, 16th and 30th; at Iowa City, on the 3d and 10th; at Fayette, Miss., on the 12th, and at St. Paul on the 5th.

(3) *Meteors* were noticed at Lyndon, Ill., on the 9th, 24th, 26th and 29th; at Afton, Iowa, on the 7th, at Point Pleasant, La., on the 2d and 4th; at Woodstock College, Md., on the 12th and 21st; at New Market, Md., on the 12th; and Detroit, Mich., on the 15th.

(4) *Earthquakes*.—One shock was felt at Colebrook, Connecticut, on the 28th. It proceeded from east to west.

(6) *Barometer and Lake-water Oscillations*.—During the month of June, a comparison of the oscillations of the barometer and of the water at Marquette, on Lake Superior, showed that they acted together twenty-seven times, and in a contrary manner sixty-three times. A similar comparison during the month of July, shows that they acted together thirty-two times, and in a contrary manner sixty-one times.

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